

PATENT ABSTRACTS OF JAPAN

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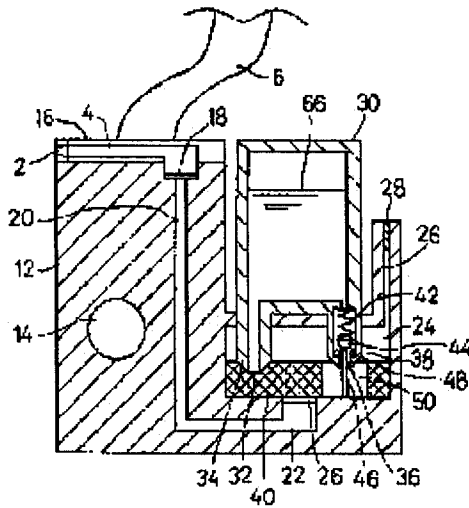
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**(54) INK SUPPLY DEVICE AND INK CARTRIDGE**

(57)Abstract:

PURPOSE: To obtain an ink cartridge and an ink supply device realizing safe loading/unloading of the ink cartridge and exhaustion of ink in the ink cartridge.

CONSTITUTION: When an ink cartridge 30 is loaded on a carriage 12, atmospheric air is introduced from an air inlet hole 36, whereby ink 66 in the ink cartridge 30 is discharged to an ink reservoir 24 through an ink discharge hole 32. When an ink pressure or an ink liquid amount in the ink reservoir 24 reaches a pre scribed value with the discharge of the ink, the discharge of the ink is stopped. After that, the ink is jetted out of an ink jet head 16. As the ink in the ink reservoir 29 is consumed, the ink discharges out of the ink cartridge 30 by this amount. A similar action is repeated until the ink in the ink cartridge 30 is exhausted.



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CLAIMS

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[Claim(s)]

[Claim 1] In the ink feeder which has the ink reservoir which supplies the ink which ink is stored and is introduced into ink jet equipment from a removable ink cartridge and said ink cartridge to an ink jet head The ink discharge hole which is prepared in said ink cartridge, touches the bottom inside an ink cartridge, and flows out the ink in the ink cartridge, In the condition of it having been prepared in said ink cartridge, having had the air installation hole which opens the interior of an ink cartridge and atmospheric air for free passage, and having been equipped with said ink cartridge The ink feeder characterized by arranging the opening edge of said ink discharge hole, and the opening edge of said air installation hole in said ink reservoir, and arranging said opening edge of said air installation hole more nearly up than the opening edge of said ink discharge hole.

[Claim 2] The ink feeder according to claim 1 characterized by having been prepared in the first lobe in which said ink discharge hole projected caudad from the base of said ink cartridge, and being prepared in the second lobe in which said air installation hole projected caudad from the base of an ink cartridge.

[Claim 3] The ink feeder according to claim 1 to which the bore which forms the critical field formed between the ink and atmospheric air in said air installation hole is characterized by being smaller than the bore of said ink discharge hole.

[Claim 4] The closing motion member is arranged movable, and open and close opening of an air installation hole by the migration in said air installation hole, The elastic member which energizes said closing motion member to said opening side of said air installation hole, and closes opening, In the condition of it having been prepared in said ink reservoir, having had the height material which can be inserted in said air installation hole, and having been equipped with said ink cartridge The ink feeder according to claim 1 characterized by inserting said height material in said air installation hole, resisting said elastic member, moving said member, and atmospheric air being open for free passage in an ink cartridge.

[Claim 5] In the ink feeder which has the ink reservoir which supplies the ink which ink is stored and is introduced into ink jet equipment from a removable ink cartridge and said ink cartridge to an ink jet head The ink discharge hole which is prepared in said ink cartridge, touches the bottom inside an ink cartridge, and flows out the ink in the ink cartridge, The air installation hole which is prepared in said ink cartridge and opens the interior of an ink cartridge and atmospheric air for free passage, In the condition of having had the free passage hole which opens said ink reservoir and said air installation hole for free passage, and having been equipped with said ink cartridge The ink feeder characterized by arranging the opening edge of said ink discharge hole, and the opening

edge of said free passage hole in said ink reservoir, and arranging said opening edge of a free passage hole more nearly up than said opening edge of an ink discharge hole.

[Claim 6] The closing motion member is arranged movable, and open and close opening of an air installation hole by the migration in said air installation hole, The elastic member which energizes said closing motion member to said opening side of said air installation hole, and closes opening, In the condition of it having been prepared in said free passage hole, having had the height material which can be inserted in said air installation hole, and having been equipped with said ink cartridge The ink feeder according to claim 5 characterized by inserting said height material in said air installation hole, resisting said elastic member, moving said member, and atmospheric air being open for free passage in an ink cartridge.

[Claim 7] In an ink cartridge removable to the ink feeder which has the ink reservoir which ink is stored and is supplied to an ink jet head The ink discharge hole which touches the bottom inside said ink cartridge and flows out the ink in the ink cartridge, In the condition of having had the air installation hole which opens said interior of an ink cartridge and atmospheric air for free passage, and having been equipped with said ink cartridge The ink cartridge characterized by arranging the opening edge of said ink discharge hole, and the opening edge of said air installation hole in said ink reservoir, and arranging said opening edge of said air installation hole more nearly up than the opening edge of said ink discharge hole.

[Claim 8] The ink cartridge according to claim 7 characterized by having been prepared in the first lobe in which said ink discharge hole projected caudad from the base of said ink cartridge, and being prepared in the second lobe in which said air installation hole projected caudad from the base of an ink cartridge.

[Claim 9] The ink cartridge according to claim 7 to which the bore which forms the critical field formed between the ink and atmospheric air in said air installation hole is characterized by being smaller than the bore of said ink discharge hole.

[Claim 10] It is an ink cartridge removable to the ink feeder which is prepared in said ink reservoir and has the height material which can be inserted in said air installation hole. The closing motion member is arranged movable, and open and close opening of an air installation hole by the migration in said air installation hole, In the condition of having energized said closing motion member to said opening side of said air installation hole, having had the elastic member which closes opening, and having been equipped with said ink cartridge The ink cartridge according to claim 7 characterized by inserting said height material in said air installation hole, resisting said elastic member, moving said member, and atmospheric air being open for free passage in an ink cartridge.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the ink feeder and ink cartridge in an ink jet printer.

[0002]

[Description of the Prior Art] Conventionally, the ink cartridge indicated by JP,61-

60773,B is proposed from the demand of the miniaturization of equipment, and improvement in the speed of printing speed. Hereafter, the outline is explained.

[0003] As shown in drawing 3 , a piezoelectric device 70 and the ink jet head 74 which consists of nozzle section 72 grades fix on the body 76 of carriage. Carriage 78 is attached in a shaft 80 free [ sliding ]. While the carriage 78 moves along the cross direction of a print form, it prints by the ink jet head 74 operating. The supply pipe 82 to which the end was connected is caudad led to the ink jet head 74 along the tooth back of an opposite hand from the body of carriage 76 upper part with the printing paper of the body 76 of carriage. The ink jet head 74 and a supply pipe 82 are held in the stair-like room formed between the carriage outer wall 84 and the body 76 of carriage, and this stair-like room is connected to the ink reservoir 86 projected and prepared in the tooth back near the body of carriage 76 base.

[0004] The air hole 88 for holding the inside of the ink reservoir 86 to atmospheric pressure is formed in the end ( drawing 3 right end) of the upper wall of the ink reservoir 86, and the upper part is equipped with the aeration filter 90. Moreover, the supply pipe 82 is inserted to near the base of the ink reservoir 86. Furthermore, the upper wall of the ink reservoir 86 is made to penetrate, and is equipped with the ink delivery tube 92 and the atmospheric-air communicating tube 94.

[0005] Here, the drawing 3 Nakagami edge of the ink delivery tube 92 and the atmospheric-air communicating tube 94 is formed in the shape of a wedge. And the ink delivery tube 92 is made shorter than the atmospheric-air communicating tube 94, and arranges the soffit of the ink delivery tube 92 near the base of the ink reservoir 86, and an upper bed makes it project from the upper wall of the ink reservoir 86. The soffit of the atmospheric-air communicating tube 94 is arranged a little caudad from the inside of the upper wall of the ink reservoir 86, and an upper bed is arranged more nearly up than the upper bed of the ink delivery tube 92. An ink cartridge 96 consists of spring materials, and the interior is filled up with ink 98.

[0006] Here, if the top face of the ink reservoir 86 is equipped as an ink cartridge 96 is inserted in the ink delivery tube 92 and the atmospheric-air communicating tube 94 from the upper part of carriage 78, the ink 98 in an ink cartridge 96 will flow in the ink reservoir 86 through the ink delivery tube 92. Since an ink cartridge 96 will be intercepted with atmospheric air if the soffit of the atmospheric-air communicating tube 94 is arrived at as the liquid ink side in the ink reservoir 86 shows drawing 3 , runoff of the ink 98 to the ink reservoir 86 stops, and ink 98 does not overflow from the ink reservoir 86.

[0007]

[Problem(s) to be Solved by the Invention] However, since the ink delivery tube 92 and the atmospheric-air communicating tube 94 which have rust-like opening which goes away in order to make an ink cartridge 96 and the ink reservoir 86 open for free passage were formed in the body of carriage as explained above, when detaching and attaching an ink cartridge 96, there was a danger of damaging an operator's hand, a finger, etc. Since said wedge-like opening fixed to carriage 78 will move at high speed when carriage 78 moves without carrying an ink cartridge 96 especially, it is dramatically dangerous.

[0008] Moreover, in order to ensure a free passage with an ink cartridge 96 and the ink reservoir 86, it is necessary to run through the ink delivery tube 92 and rust-like opening which goes away atmospheric-air communicating tube 94 in an ink cartridge 96 to some

extent. Therefore, the ink which exists caudad from opening of the ink delivery tube 92 which projected in the ink cartridge 96 cannot be exhausted. Furthermore, when it secedes from carriage 78 from an ink cartridge 96, from opening of the ink delivery tube 92, the ink in which the lower part remained will leak from the part into which the ink delivery tube 92 and the atmospheric-air communicating tube 94 penetrated the ink cartridge 96, and equipment will become dirty.

[0009] It is the object to offer the ink feeder and ink cartridge which can be made in order that this invention may solve the trouble mentioned above, and an ink cartridge can be detached and attached safely, and can exhaust the ink in an ink cartridge.

[0010]

[Means for Solving the Problem] In order to attain this object in claim 1 of this invention In the ink feeder which has the ink reservoir which supplies the ink which ink is stored and is introduced into ink jet equipment from a removable ink cartridge and said ink cartridge to an ink jet head The ink discharge hole which is prepared in said ink cartridge, touches the bottom inside an ink cartridge, and flows out the ink in the ink cartridge, In the condition of it having been prepared in said ink cartridge, having had the air installation hole which opens the interior of an ink cartridge and atmospheric air for free passage, and having been equipped with said ink cartridge The opening edge of said ink discharge hole and the opening edge of said air installation hole are arranged in said ink reservoir, and said opening edge of said air installation hole is arranged more nearly up than the opening edge of said ink discharge hole.

[0011] Ink is stored in claim 5. Moreover, an ink cartridge removable to ink jet equipment, In the ink feeder which has the ink reservoir which supplies the ink introduced from said ink cartridge to an ink jet head The ink discharge hole which is prepared in said ink cartridge, touches the bottom inside an ink cartridge, and flows out the ink in the ink cartridge, The air installation hole which is prepared in said ink cartridge and opens the interior of an ink cartridge and atmospheric air for free passage, In the condition of having had the free passage hole which opens said ink reservoir and said air installation hole for free passage, and having been equipped with said ink cartridge The opening edge of said ink discharge hole and the opening edge of said free passage hole are arranged in said ink reservoir, and said opening edge of a free passage hole is arranged more nearly up than said opening edge of an ink discharge hole.

[0012] Furthermore, in claim 7, ink is stored and it sets to an ink cartridge removable to the ink feeder which has the ink reservoir supplied to an ink jet head. The ink discharge hole which touches the bottom inside said ink cartridge and flows out the ink in the ink cartridge, In the condition of having had the air installation hole which opens said interior of an ink cartridge and atmospheric air for free passage, and having been equipped with said ink cartridge The opening edge of said ink discharge hole and the opening edge of said air installation hole are arranged in said ink reservoir, and said opening edge of said air installation hole is arranged more nearly up than the opening edge of said ink discharge hole.

[0013]

[Function] In this invention which has the above-mentioned configuration, in the state of [ discharge hole / ink ] wearing of the ink cartridge in which ink was stored, air is introduced from said air installation hole, and the ink in an ink cartridge flows into an ink reservoir. In connection with it, if ink \*\* or the amount of liquid ink in an ink reservoir

reaches the specified quantity, runoff will stop. Then, if ink is injected from an ink jet head and the ink in an ink reservoir is consumed, the same actuation will be repeated until ink flows out and only the part exhausts the ink in an ink cartridge from an ink cartridge.

[0014]

[Example] Hereafter, one example which materialized this invention is explained with reference to a drawing.

[0015] As shown in drawing 1, carriage 12 records on a shaft 14 by gushing ink by the ink jet head 16, enabling both-way migration of the sliding along the cross direction of a mounting eclipse and the record form which is not illustrated. The ink jet head 16 consists of a nozzle member 2, a piezoelectric device 4, and connector 6 grade, and the piezoelectric device 4 and the connector 6 are connected with the signal line which is not illustrated. And the electrical signal according to the image information recorded from the outside is supplied to a connector 6. Then, a piezoelectric device 4 drives and ink is spouted.

[0016] The ink jet head 16 turns to a record form the direction which spouts ink, and is being fixed to carriage 12, and the supply pipe 20 which supplies ink to the ink jet head 16 is connected to the ink jet head 16 through the filters 18, such as a stainless steel mesh. The supply pipe 20 is caudad led from the ink jet head 16, is bent by L typeface at the pars basilaris ossis occipitalis of carriage 12 at the drawing 1 Nakamigi side, and is connected to the liquid room 22. And the liquid room 22 is opened for free passage through the filter 26 by the ink reservoir 24 located in the upper part. The air hole 26 for holding the inside of the ink reservoir 24 to atmospheric pressure is formed in the upper wall on drawing 1 R>1 Nakamigi of the ink reservoir 24, and the upper part is equipped with the aeration filter 28.

[0017] The first lobe 34 and the second lobe 38 are formed in the base of the ink cartridge 30 with which it is loaded above the ink reservoir 24, and the die length of the first lobe 34 is formed in it for a long time than the die length of the second lobe 38. The ink discharge hole 32 which derives the ink in an ink cartridge 30 to the ink reservoir 24 is formed in the first lobe 34, and the air installation hole 36 which introduces air in an ink cartridge 30 is formed in the second lobe. And in consideration of the water head pressure of the surface tension of the ink with which an ink cartridge 30 is filled up, viscosity, and ink, the bore of the ink discharge hole 32 is designed like and proper not beginning to leak in vain, when the body 12 of carriage is not loaded. Moreover, the bore of the air installation hole 36 is also designed by the appearance into which air flows proper.

[0018] And in the air installation hole 36, the spring 42 which a ball 44 is formed movable and energizes the ball 44 to opening by the side of the atmospheric air of the air installation hole 36 is formed. Moreover, O ring 48 is arranged at the lower part of a ball 44. For this reason, in the condition of not being equipped with the ink cartridge 30, a ball 44 is pressed by O ring 48 and opening by the side of the atmospheric air of the air installation hole 36 is closed by energization of a spring 42.

[0019] By the way, in the air installation hole 36 in the second lobe 38 of an ink cartridge 30, if the bore in which the critical field of ink 66 and atmospheric air is formed designs smaller than the bore of the ink discharge hole 32 of the first lobe 34, that ink flows into the air installation hole 36 can prevent easily with the surface tension of the critical field. For this reason, O ring 48 grade does not deteriorate in ink 66.

[0020] And the hole where the first lobe 34 and the second lobe 38 are inserted is prepared, respectively at the same time the upper wall of the ink reservoir 24 is loaded with an ink cartridge 30. Moreover, the form 40 which is a porous member is held in the ink reservoir 24, where a pressure welding is moderately carried out to a filter 22. The notching section 50 is formed in the form 40, the second lobe 38 is inserted and the notching section 50 is arranged in the location. Prevention of scattering of the ink in the ink reservoir 24 at the time of carriage 12 carrying out both-way migration at high speed and relaxation of rapid pressure fluctuation are performed by this form 40.

[0021] Moreover, when carriage 12 is loaded with an ink cartridge 30, it is inserted in the air installation hole 36, and the height material 46 which resists a spring 42 and presses a ball 44 is installed in the low wall of the ink reservoir 24. The edge of the height material 46 is arranged in the ink reservoir 24.

[0022] If the top face of the ink reservoir 24 is equipped with the ink cartridge 30 filled up with ink 66 here as the first lobe 34 and the second lobe 38 are inserted in said hole of the upper wall of the ink reservoir 24 from the upper part of carriage 12. The height material 46 resists a spring 42, and moves a ball 44 up, opening by the side of the atmospheric air of the air installation hole 36 is opened, and air is introduced in an ink cartridge 30. Then, the ink 66 in an ink cartridge 30 flows in the ink reservoir 24 from the ink discharge hole 32. In the condition of having been equipped with this ink cartridge 30, while the opening edge by the side of the atmospheric air of the ink discharge hole 32 and the opening edge by the side of the atmospheric air of the air installation hole 36 are arranged in the ink reservoir 24, the opening edge by the side of the atmospheric air of the air installation hole 36 is arranged more nearly up than the opening edge by the side of the atmospheric air of the ink discharge hole 32.

[0023] When its critical side holding power influenced by the granularity of the eye of form 40 and the surface tension of ink which are the peripheral surface of the notching section 50 is larger than the water head pressure of the ink 66 in an ink cartridge 30 after the ink which flowed into the ink reservoir 24 permeates the form 40 whole, it oozes out in the notching section 50, and the liquid ink side in the notching section 50 goes up. And if the liquid ink side in the notching section 50 reaches the air installation hole 36, in an ink cartridge 30, it will be intercepted from atmospheric air and runoff of the ink 66 into the ink reservoir 24 will stop.

[0024] Moreover, when the interface holding power influenced by the granularity of the eye of form 40 and the surface tension of ink which are the peripheral surface of the notching section 50 is smaller than the water head pressure of the ink 66 in an ink cartridge 30, ink 66 is discharged from an ink discharge hole until it balances with ink \*\* which form 40 is filled up with ink by the surface tension in the ink criticality side of the notching section 50, and ink \*\* in form 40 commits in form 40 from the exterior with it, without ink oozing from the notching section 50.

[0025] Here, form 40 is selected proper in ink to the relaxation force of the pressure fluctuation generated in the water head pressure of ink and the migration of carriage 12 other than critical side holding power which were mentioned above, and the ink jet head 16 in consideration of the static ink pressure concerning the viscous drag at the time of supply, and the ink jet head 16 etc. In addition, although the ink jet head 16 is arranged above the ink cartridge 30 in this example, since the path of the nozzle member 2 is as small enough as dozens of microns, the capillary tube stress is maintaining the water head



difference and balance from the ink jet head 16 to form 40.

[0026] And if ink is spouted from the ink jet head 16, ink will be attracted with the capillary tube stress of the nozzle member 2, and the ink in form 40 will be consumed. If the ink in form 40 is consumed, ink \*\* in form 40 will fall, or the liquid ink sides of the notching section 50 will decrease in number, and form 40 will be filled up with ink from an ink cartridge 30 to the condition before ink is consumed. While the air in the ink reservoir 24 is introduced in an ink cartridge 30, the ink reservoir 24 is supplemented with external air via the aeration filter 28 and an air hole 26, and the inside of the ink reservoir 24 is maintained at atmospheric pressure. By repeating the actuation of ink makeup mentioned above, the ink of a fixed pressure can be supplied to the ink jet head 16 until the ink 66 in an ink cartridge 30 is lost.

[0027] In addition, when the ink path from the ink jet head 16 to a filter 26 is not beforehand filled up with ink, from the side by which the ink of the nozzle member 16 is spouted, it equips with the attraction means which is not illustrated, ink is attracted from the ink reservoir 24, and said ink path is filled up with ink.

[0028] Since the ink discharge hole 32 is formed in the base of an ink cartridge 30 as mentioned above, the ink 66 in an ink cartridge can be exhausted altogether. Moreover, where carriage 12 is equipped with an ink cartridge 30, since the opening edge by the side of the atmospheric air of the air installation hole 36 is arranged more nearly up than the opening edge by the side of the atmospheric air of the ink discharge hole 32, the path of the ink discharge hole 32 can be enlarged to some extent. For this reason, even if the ink 66 in an ink cartridge 30 decreases and \*\*\*\*\* of ink 66 becomes low, ink 66 is drawn from the ink discharge hole 32 by the ink reservoir 24, and ink 66 can be exhausted altogether. Thus, since the ink 66 in an ink cartridge 30 can be exhausted altogether, the hand of equipment and an operator etc. does not become dirty in the ink 66 which remained in the ink cartridge 30 at the time of exchange of an ink cartridge 30.

[0029] Furthermore, since the projecting member is not arranged in the exterior of carriage 12, attachment and detachment of an ink cartridge 30 can carry out to insurance.

[0030] Moreover, in the condition that carriage 12 is not equipped with the ink cartridge 30, since the air installation hole 36 is closed, ink 66 is not discharged with them until carriage 12 is equipped with an ink cartridge 30 by a ball 44, a spring 42, and O ring 48. For this reason, in attachment and detachment of an ink cartridge 30, a hand etc. does not become dirty.

[0031] Next, other examples of this invention are explained with reference to drawing 2. The same encoder signal is given to the same member as the example of drawing 1 below, and the explanation is omitted.

[0032] The first lobe 34 which has the ink discharge hole 32 is formed in the base of ink cartridge 30a with which it is loaded above ink reservoir 24a, and second lobe 38a which has air installation hole 36a is formed in the drawing 2 Nakamigi side. Inside second lobe 38a, ball 44a is energized downward by spring 42a. And when carriage 12a is not loaded with ink cartridge 30a, ball 44a pressed O ring 48a prepared in the air installation hole 36a lower part, and air installation hole 36a is shielded.

[0033] The air installation way 64 is formed in the upper wall on drawing 2 Nakamigi of ink reservoir 24a. O ring 62 and height material 46a are prepared in the upper part of the air installation way 64. Moreover, opening of the soffit of the air installation way 64 is arranged in ink reservoir 24a. And if loaded with ink cartridge 30a, while the opening

edge by the side of the atmospheric air of air installation hole 36a will contact O ring 62, height material 46a resists spring 42a, and moves ball 44a up. Then, the inside of ink cartridge 30a is opened for free passage with the ink reservoir 24 through air installation hole 36a and the air installation way 64. At this time, the soffit of the air installation way 64 is arranged more nearly up than the opening edge by the side of the atmospheric air of the ink discharge hole 32.

[0034] And atmospheric air is introduced into the interior of ink cartridge 30a through the air installation way 64 and air installation hole 36a from ink reservoir 24a, and the ink 66 inside ink cartridge 30a is discharged by ink reservoir 24a from the ink discharge hole 32. Makeup to ink reservoir 24a accompanying injection of ink is performed like the example of drawing 1.

[0035] Thus, even if constituted, the same effectiveness as the example of drawing 1 is acquired.

[0036]

[Effect of the Invention] Like [ it is \*\*\*\*\* from having explained above and ], according to this invention, since the ink discharge hole is prepared in the bottom of an ink cartridge, all the ink in an ink cartridge can be exhausted. Moreover, since the soffit of the hole with which air is introduced in an ink cartridge is arranged more nearly up than the opening edge of an ink discharge hole, the path of an ink discharge hole can be formed somewhat greatly. For this reason, even if the ink in an ink cartridge decreases and \*\*\*\*\* of ink becomes low, ink is drawn from an ink discharge hole and all ink can be exhausted. Thus, since all the ink in an ink cartridge can be exhausted, the hand of equipment and an operator etc. does not become dirty in the ink which remained in the ink cartridge at the time of exchange of an ink cartridge. Furthermore, since the member which projected around the part equipped with an ink cartridge is not prepared, an ink cartridge can be detached and attached safely.

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## TECHNICAL FIELD

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[Industrial Application] This invention relates to the ink feeder and ink cartridge in an ink jet printer.

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## PRIOR ART

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[Description of the Prior Art] Conventionally, the ink cartridge indicated by JP,61-60773,B is proposed from the demand of the miniaturization of equipment, and improvement in the speed of printing speed. Hereafter, the outline is explained.

[0003] As shown in drawing 3, a piezoelectric device 70 and the ink jet head 74 which consists of nozzle section 72 grades fix on the body 76 of carriage. Carriage 78 is attached in a shaft 80 free [ sliding ]. While the carriage 78 moves along the cross direction of a print form, it prints by the ink jet head 74 operating. The supply pipe 82 to which the end was connected is caudad led to the ink jet head 74 along the tooth back of an opposite hand from the body of carriage 76 upper part with the printing paper of the body 76 of carriage. The ink jet head 74 and a supply pipe 82 are held in the stair-like

room formed between the carriage outer wall 84 and the body 76 of carriage, and this stair-like room is connected to the ink reservoir 86 projected and prepared in the tooth back near the body of carriage 76 base.

[0004] The air hole 88 for holding the inside of the ink reservoir 86 to atmospheric pressure is formed in the end ( drawing 3 right end) of the upper wall of the ink reservoir 86, and the upper part is equipped with the aeration filter 90. Moreover, the supply pipe 82 is inserted to near the base of the ink reservoir 86. Furthermore, the upper wall of the ink reservoir 86 is made to penetrate, and is equipped with the ink delivery tube 92 and the atmospheric-air communicating tube 94.

[0005] Here, the drawing 3 Nakagami edge of the ink delivery tube 92 and the atmospheric-air communicating tube 94 is formed in the shape of a wedge. And the ink delivery tube 92 is made shorter than the atmospheric-air communicating tube 94, and arranges the soffit of the ink delivery tube 92 near the base of the ink reservoir 86, and an upper bed makes it project from the upper wall of the ink reservoir 86. The soffit of the atmospheric-air communicating tube 94 is arranged a little caudad from the inside of the upper wall of the ink reservoir 86, and an upper bed is arranged more nearly up than the upper bed of the ink delivery tube 92. An ink cartridge 96 consists of spring materials, and the interior is filled up with ink 98.

[0006] Here, if the top face of the ink reservoir 86 is equipped as an ink cartridge 96 is inserted in the ink delivery tube 92 and the atmospheric-air communicating tube 94 from the upper part of carriage 78, the ink 98 in an ink cartridge 96 will flow in the ink reservoir 86 through the ink delivery tube 92. Since an ink cartridge 96 will be intercepted with atmospheric air if the soffit of the atmospheric-air communicating tube 94 is arrived at as the liquid ink side in the ink reservoir 86 shows drawing 3 , runoff of the ink 98 to the ink reservoir 86 stops, and ink 98 does not overflow from the ink reservoir 86.

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## EFFECT OF THE INVENTION

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[Effect of the Invention] Like [ it is \*\*\*\*\* from having explained above and ], according to this invention, since the ink discharge hole is prepared in the bottom of an ink cartridge, all the ink in an ink cartridge can be exhausted. Moreover, since the soffit of the hole with which air is introduced in an ink cartridge is arranged more nearly up than the opening edge of an ink discharge hole, the path of an ink discharge hole can be formed somewhat greatly. For this reason, even if the ink in an ink cartridge decreases and \*\*\*\*\* of ink becomes low, ink is drawn from an ink discharge hole and all ink can be exhausted. Thus, since all the ink in an ink cartridge can be exhausted, the hand of equipment and an operator etc. does not become dirty in the ink which remained in the ink cartridge at the time of exchange of an ink cartridge. Furthermore, since the member which projected around the part equipped with an ink cartridge is not prepared, an ink cartridge can be detached and attached safely.

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## TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] However, since the ink delivery tube 92 and the atmospheric-air communicating tube 94 which have rust-like opening which goes away in order to make an ink cartridge 96 and the ink reservoir 86 open for free passage were formed in the body of carriage as explained above, when detaching and attaching an ink cartridge 96, there was a danger of damaging an operator's hand, a finger, etc. Since said wedge-like opening fixed to carriage 78 will move at high speed when carriage 78 moves without carrying an ink cartridge 96 especially, it is dramatically dangerous.

[0008] Moreover, in order to ensure a free passage with an ink cartridge 96 and the ink reservoir 86, it is necessary to run through the ink delivery tube 92 and rust-like opening which goes away atmospheric-air communicating tube 94 in an ink cartridge 96 to some extent. Therefore, the ink which exists caudad from opening of the ink delivery tube 92 which projected in the ink cartridge 96 cannot be exhausted. Furthermore, when it secedes from carriage 78 from an ink cartridge 96, from opening of the ink delivery tube 92, the ink in which the lower part remained will leak from the part into which the ink delivery tube 92 and the atmospheric-air communicating tube 94 penetrated the ink cartridge 96, and equipment will become dirty.

[0009] It is the object to offer the ink feeder and ink cartridge which can be made in order that this invention may solve the trouble mentioned above, and an ink cartridge can be detached and attached safely, and can exhaust the ink in an ink cartridge.

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## MEANS

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[Means for Solving the Problem] In order to attain this object in claim 1 of this invention In the ink feeder which has the ink reservoir which supplies the ink which ink is stored and is introduced into ink jet equipment from a removable ink cartridge and said ink cartridge to an ink jet head The ink discharge hole which is prepared in said ink cartridge, touches the bottom inside an ink cartridge, and flows out the ink in the ink cartridge, In the condition of it having been prepared in said ink cartridge, having had the air installation hole which opens the interior of an ink cartridge and atmospheric air for free passage, and having been equipped with said ink cartridge The opening edge of said ink discharge hole and the opening edge of said air installation hole are arranged in said ink reservoir, and said opening edge of said air installation hole is arranged more nearly up than the opening edge of said ink discharge hole.

[0011] Ink is stored in claim 5. Moreover, an ink cartridge removable to ink jet equipment, In the ink feeder which has the ink reservoir which supplies the ink introduced from said ink cartridge to an ink jet head The ink discharge hole which is prepared in said ink cartridge, touches the bottom inside an ink cartridge, and flows out the ink in the ink cartridge, The air installation hole which is prepared in said ink cartridge and opens the interior of an ink cartridge and atmospheric air for free passage, In the condition of having had the free passage hole which opens said ink reservoir and said air installation hole for free passage, and having been equipped with said ink cartridge The opening edge of said ink discharge hole and the opening edge of said free passage hole are arranged in said ink reservoir, and said opening edge of a free passage hole is arranged more nearly up than said opening edge of an ink discharge hole.

[0012] Furthermore, in claim 7, ink is stored and it sets to an ink cartridge removable to

the ink feeder which has the ink reservoir supplied to an ink jet head. The ink discharge hole which touches the bottom inside said ink cartridge and flows out the ink in the ink cartridge, In the condition of having had the air installation hole which opens said interior of an ink cartridge and atmospheric air for free passage, and having been equipped with said ink cartridge The opening edge of said ink discharge hole and the opening edge of said air installation hole are arranged in said ink reservoir, and said opening edge of said air installation hole is arranged more nearly up than the opening edge of said ink discharge hole.

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## OPERATION

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[Function] In this invention which has the above-mentioned configuration, in the state of [ discharge hole / ink ] wearing of the ink cartridge in which ink was stored, air is introduced from said air installation hole, and the ink in an ink cartridge flows into an ink reservoir. In connection with it, if ink \*\* or the amount of liquid ink in an ink reservoir reaches the specified quantity, runoff will stop. Then, if ink is injected from an ink jet head and the ink in an ink reservoir is consumed, the same actuation will be repeated until ink flows out and only the part exhausts the ink in an ink cartridge from an ink cartridge.

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## EXAMPLE

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[Example] Hereafter, one example which materialized this invention is explained with reference to a drawing.

[0015] As shown in drawing 1 , carriage 12 records on a shaft 14 by gushing ink by the ink jet head 16, enabling both-way migration of the sliding along the cross direction of a mounting eclipse and the record form which is not illustrated. The ink jet head 16 consists of a nozzle member 2, a piezoelectric device 4, and connector 6 grade, and the piezoelectric device 4 and the connector 6 are connected with the signal line which is not illustrated. And the electrical signal according to the image information recorded from the outside is supplied to a connector 6. Then, a piezoelectric device 4 drives and ink is spouted.

[0016] The ink jet head 16 turns to a record form the direction which spouts ink, and is being fixed to carriage 12, and the supply pipe 20 which supplies ink to the ink jet head 16 is connected to the ink jet head 16 through the filters 18, such as a stainless steel mesh. The supply pipe 20 is caudad led from the ink jet head 16, is bent by L typeface at the pars basilaris ossis occipitalis of carriage 12 at the drawing 1 Nakamigi side, and is connected to the liquid room 22. And the liquid room 22 is opened for free passage through the filter 26 by the ink reservoir 24 located in the upper part. The air hole 26 for holding the inside of the ink reservoir 24 to atmospheric pressure is formed in the upper wall on drawing 1 R>1 Nakamigi of the ink reservoir 24, and the upper part is equipped with the aeration filter 28.

[0017] The first lobe 34 and the second lobe 38 are formed in the base of the ink cartridge 30 with which it is loaded above the ink reservoir 24, and the die length of the first lobe

34 is formed in it for a long time than the die length of the second lobe 38. The ink discharge hole 32 which derives the ink in an ink cartridge 30 to the ink reservoir 24 is formed in the first lobe 34, and the air installation hole 36 which introduces air in an ink cartridge 30 is formed in the second lobe. And in consideration of the water head pressure of the surface tension of the ink with which an ink cartridge 30 is filled up, viscosity, and ink, the bore of the ink discharge hole 32 is designed like and proper not beginning to leak in vain, when the body 12 of carriage is not loaded. Moreover, the bore of the air installation hole 36 is also designed by the appearance into which air flows proper.

[0018] And in the air installation hole 36, the spring 42 which a ball 44 is formed movable and energizes the ball 44 to opening by the side of the atmospheric air of the air installation hole 36 is formed. Moreover, O ring 48 is arranged at the lower part of a ball 44. For this reason, in the condition of not being equipped with the ink cartridge 30, a ball 44 is pressed by O ring 48 and opening by the side of the atmospheric air of the air installation hole 36 is closed by energization of a spring 42.

[0019] By the way, in the air installation hole 36 in the second lobe 38 of an ink cartridge 30, if the bore in which the critical field of ink 66 and atmospheric air is formed designs smaller than the bore of the ink discharge hole 32 of the first lobe 34, that ink flows into the air installation hole 36 can prevent easily with the surface tension of the critical field. For this reason, O ring 48 grade does not deteriorate in ink 66.

[0020] And the hole where the first lobe 34 and the second lobe 38 are inserted is prepared, respectively at the same time the upper wall of the ink reservoir 24 is loaded with an ink cartridge 30. Moreover, the form 40 which is a porous member is held in the ink reservoir 24, where a pressure welding is moderately carried out to a filter 22. The notching section 50 is formed in the form 40, the second lobe 38 is inserted and the notching section 50 is arranged in the location. Prevention of scattering of the ink in the ink reservoir 24 at the time of carriage 12 carrying out both-way migration at high speed and relaxation of rapid pressure fluctuation are performed by this form 40.

[0021] Moreover, when carriage 12 is loaded with an ink cartridge 30, it is inserted in the air installation hole 36, and the height material 46 which resists a spring 42 and presses a ball 44 is installed in the low wall of the ink reservoir 24. The edge of the height material 46 is arranged in the ink reservoir 24.

[0022] If the top face of the ink reservoir 24 is equipped with the ink cartridge 30 filled up with ink 66 here as the first lobe 34 and the second lobe 38 are inserted in said hole of the upper wall of the ink reservoir 24 from the upper part of carriage 12 The height material 46 resists a spring 42, and moves a ball 44 up, opening by the side of the atmospheric air of the air installation hole 36 is opened, and air is introduced in an ink cartridge 30. Then, the ink 66 in an ink cartridge 30 flows in the ink reservoir 24 from the ink discharge hole 32. In the condition of having been equipped with this ink cartridge 30, while the opening edge by the side of the atmospheric air of the ink discharge hole 32 and the opening edge by the side of the atmospheric air of the air installation hole 36 are arranged in the ink reservoir 24, the opening edge by the side of the atmospheric air of the air installation hole 36 is arranged more nearly up than the opening edge by the side of the atmospheric air of the ink discharge hole 32.

[0023] When its critical side holding power influenced by the granularity of the eye of form 40 and the surface tension of ink which are the peripheral surface of the notching section 50 is larger than the water head pressure of the ink 66 in an ink cartridge 30 after

the ink which flowed into the ink reservoir 24 permeates the form 40 whole, it oozes out in the notching section 50, and the liquid ink side in the notching section 50 goes up. And if the liquid ink side in the notching section 50 reaches the air installation hole 36, in an ink cartridge 30, it will be intercepted from atmospheric air and runoff of the ink 66 into the ink reservoir 24 will stop.

[0024] Moreover, when the interface holding power influenced by the granularity of the eye of form 40 and the surface tension of ink which are the peripheral surface of the notching section 50 is smaller than the water head pressure of the ink 66 in an ink cartridge 30, ink 66 is discharged from an ink discharge hole until it balances with ink \*\* which form 40 is filled up with ink by the surface tension in the ink criticality side of the notching section 50, and ink \*\* in form 40 commits in form 40 from the exterior with it, without ink oozing from the notching section 50.

[0025] Here, form 40 is selected proper in ink to the relaxation force of the pressure fluctuation generated in the water head pressure of ink and the migration of carriage 12 other than critical side holding power which were mentioned above, and the ink jet head 16 in consideration of the static ink pressure concerning the viscous drag at the time of supply, and the ink jet head 16 etc. In addition, although the ink jet head 16 is arranged above the ink cartridge 30 in this example, since the path of the nozzle member 2 is as small enough as dozens of microns, the capillary tube stress is maintaining the water head difference and balance from the ink jet head 16 to form 40.

[0026] And if ink is spouted from the ink jet head 16, ink will be attracted with the capillary tube stress of the nozzle member 2, and the ink in form 40 will be consumed. If the ink in form 40 is consumed, ink \*\* in form 40 will fall, or the liquid ink sides of the notching section 50 will decrease in number, and form 40 will be filled up with ink from an ink cartridge 30 to the condition before ink is consumed. While the air in the ink reservoir 24 is introduced in an ink cartridge 30, the ink reservoir 24 is supplemented with external air via the aeration filter 28 and an air hole 26, and the inside of the ink reservoir 24 is maintained at atmospheric pressure. By repeating the actuation of ink makeup mentioned above, the ink of a fixed pressure can be supplied to the ink jet head 16 until the ink 66 in an ink cartridge 30 is lost.

[0027] In addition, when the ink path from the ink jet head 16 to a filter 26 is not beforehand filled up with ink, from the side by which the ink of the nozzle member 16 is spouted, it equips with the attraction means which is not illustrated, ink is attracted from the ink reservoir 24, and said ink path is filled up with ink.

[0028] Since the ink discharge hole 32 is formed in the base of an ink cartridge 30 as mentioned above, the ink 66 in an ink cartridge can be exhausted altogether. Moreover, where carriage 12 is equipped with an ink cartridge 30, since the opening edge by the side of the atmospheric air of the air installation hole 36 is arranged more nearly up than the opening edge by the side of the atmospheric air of the ink discharge hole 32, the path of the ink discharge hole 32 can be enlarged to some extent. For this reason, even if the ink 66 in an ink cartridge 30 decreases and \*\*\*\*\* of ink 66 becomes low, ink 66 is drawn from the ink discharge hole 32 by the ink reservoir 24, and ink 66 can be exhausted altogether. Thus, since the ink 66 in an ink cartridge 30 can be exhausted altogether, the hand of equipment and an operator etc. does not become dirty in the ink 66 which remained in the ink cartridge 30 at the time of exchange of an ink cartridge 30.

[0029] Furthermore, since the projecting member is not arranged in the exterior of

carriage 12, attachment and detachment of an ink cartridge 30 can carry out to insurance. [0030] Moreover, in the condition that carriage 12 is not equipped with the ink cartridge 30, since the air installation hole 36 is closed, ink 66 is not discharged with them until carriage 12 is equipped with an ink cartridge 30 by a ball 44, a spring 42, and O ring 48. For this reason, in attachment and detachment of an ink cartridge 30, a hand etc. does not become dirty.

[0031] Next, other examples of this invention are explained with reference to drawing 2. The same encoder signal is given to the same member as the example of drawing 1 below, and the explanation is omitted.

[0032] The first lobe 34 which has the ink discharge hole 32 is formed in the base of ink cartridge 30a with which it is loaded above ink reservoir 24a, and second lobe 38a which has air installation hole 36a is formed in the drawing 2 Nakamigi side. Inside second lobe 38a, ball 44a is energized downward by spring 42a. And when carriage 12a is not loaded with ink cartridge 30a, ball 44a pressed O ring 48a prepared in the air installation hole 36a lower part, and air installation hole 36a is shielded.

[0033] The air installation way 64 is formed in the upper wall on drawing 2 Nakamigi of ink reservoir 24a. O ring 62 and height material 46a are prepared in the upper part of the air installation way 64. Moreover, opening of the soffit of the air installation way 64 is arranged in ink reservoir 24a. And if loaded with ink cartridge 30a, while the opening edge by the side of the atmospheric air of air installation hole 36a will contact O ring 62, height material 46a resists spring 42a, and moves ball 44a up. Then, the inside of ink cartridge 30a is opened for free passage with the ink reservoir 24 through air installation hole 36a and the air installation way 64. At this time, the soffit of the air installation way 64 is arranged more nearly up than the opening edge by the side of the atmospheric air of the ink discharge hole 32.

[0034] And atmospheric air is introduced into the interior of ink cartridge 30a through the air installation way 64 and air installation hole 36a from ink reservoir 24a, and the ink 66 inside ink cartridge 30a is discharged by ink reservoir 24a from the ink discharge hole 32. Makeup to ink reservoir 24a accompanying injection of ink is performed like the example of drawing 1.

[0035] Thus, even if constituted, the same effectiveness as the example of drawing 1 is acquired.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing the ink feeder and ink cartridge of one example of this invention.

[Drawing 2] It is the block diagram showing other ink feeders and ink cartridges of an example of this invention.

[Drawing 3] It is the block diagram showing the ink feeder and ink cartridge of an example of the conventional technique.

[Description of Notations]

16 Ink Jet Head

24 Ink Reservoir



Machine English Translation of JP 06-286151

30 Ink Cartridge

32 Ink Discharge Hole

36 Air Installation Hole

66 Ink

(51)Int.Cl.<sup>5</sup>

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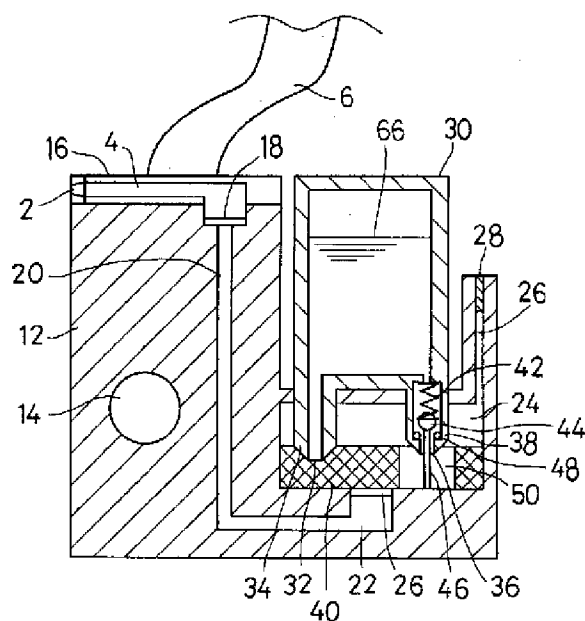
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(54)【発明の名称】 インク供給装置及びインクカートリッジ

(57)【要約】

【目的】 インクカートリッジの着脱を安全に行え、且つインクカートリッジ内のインクを使いきることができるインク供給装置及びインクカートリッジを提供すること。

【構成】 インクカートリッジ30をキャリッジ12に装着すると、空気導入孔36から大気が導入され、インクカートリッジ30内のインク66がインク排出孔32よりインク溜め24へと流出する。それに伴って、インク溜め24内のインク圧、もしくはインク液量が所定量に達すると流出が止まる。その後、インクジェットヘッド16からインクが噴射され、インク溜め24内のインクが消費されると、その分だけインクカートリッジ30よりインクが流出し、インクカートリッジ30内のインクを使いきるまで、同様な動作が繰り返される。



【特許請求の範囲】

【請求項1】 インクが貯蔵され、インクジェット装置に着脱可能なインクカートリッジと、前記インクカートリッジから導入されるインクをインクジェットヘッドに供給するインク溜めとを有するインク供給装置において、

前記インクカートリッジに設けられ、インクカートリッジ内部の最下部に接し、そのインクカートリッジ内のインクを流出するインク排出孔と、

前記インクカートリッジに設けられ、そのインクカートリッジ内部と大気とを連通する空気導入孔とを備え、前記インクカートリッジが装着された状態では、前記インク排出孔の開口端及び前記空気導入孔の開口端が前記インク溜め内に配置され、且つ前記空気導入孔の前記開口端が前記インク排出孔の開口端より上方に配置されていることを特徴とするインク供給装置。

【請求項2】 前記インク排出孔が前記インクカートリッジの底面から下方に突出した第一突出部に設けられ、前記空気導入孔がインクカートリッジの底面から下方に突出した第二突出部に設けられたことを特徴とする請求項1記載のインク供給装置。

【請求項3】 前記空気導入孔における、インクと大気との間に形成される臨界面を形成する内径が、前記インク排出孔の内径よりも小さいことを特徴とする請求項1記載のインク供給装置。

【請求項4】 前記空気導入孔内に移動可能に配置され、その移動により空気導入孔の開口を開閉する開閉部材と、前記開閉部材を前記空気導入孔の前記開口側に付勢し、開口を閉じる弾性部材と、前記インク溜めに設けられ、前記空気導入孔に挿入可能な突起部材とを備え、前記インクカートリッジが装着された状態では、前記突起部材が前記空気導入孔に挿入され、前記弾性部材に抗して前記部材が移動され、インクカートリッジ内と大気とが連通することを特徴とする請求項1記載のインク供給装置。

【請求項5】 インクが貯蔵され、インクジェット装置に着脱可能なインクカートリッジと、前記インクカートリッジから導入されるインクをインクジェットヘッドに供給するインク溜めとを有するインク供給装置において、

前記インクカートリッジに設けられ、インクカートリッジ内部の最下部に接し、そのインクカートリッジ内のインクを流出するインク排出孔と、

前記インクカートリッジに設けられ、そのインクカートリッジ内部と大気とを連通する空気導入孔と、

前記インク溜めと前記空気導入孔とを連通する連通孔とを備え、

前記インクカートリッジが装着された状態では、前記インク排出孔の開口端及び前記連通孔の開口端とが前記インク溜め内に配置され、且つ連通孔の前記開口端がイン

ク排出孔の前記開口端より上方に配置されていることを特徴とするインク供給装置。

【請求項6】 前記空気導入孔内に移動可能に配置され、その移動により空気導入孔の開口を開閉する開閉部材と、前記開閉部材を前記空気導入孔の前記開口側に付勢し、開口を閉じる弾性部材と、前記連通孔に設けられ、前記空気導入孔に挿入可能な突起部材とを備え、前記インクカートリッジが装着された状態では、前記突起部材が前記空気導入孔に挿入され、前記弾性部材に抗して前記部材が移動され、インクカートリッジ内と大気とが連通することを特徴とする請求項5記載のインク供給装置。

【請求項7】 インクが貯蔵され、インクジェットヘッドに供給するインク溜めを有するインク供給装置に着脱可能なインクカートリッジにおいて、

前記インクカートリッジ内部の最下部に接し、そのインクカートリッジ内のインクを流出するインク排出孔と、前記インクカートリッジ内部と大気とを連通する空気導入孔とを備え、

前記インクカートリッジが装着された状態では、前記インク排出孔の開口端及び前記空気導入孔の開口端が前記インク溜め内に配置され、且つ前記空気導入孔の前記開口端が前記インク排出孔の開口端より上方に配置されていることを特徴とするインクカートリッジ。

【請求項8】 前記インク排出孔が前記インクカートリッジの底面から下方に突出した第一突出部に設けられ、前記空気導入孔がインクカートリッジの底面から下方に突出した第二突出部に設けられたことを特徴とする請求項7記載のインクカートリッジ。

【請求項9】 前記空気導入孔における、インクと大気との間に形成される臨界面を形成する内径が、前記インク排出孔の内径よりも小さいことを特徴とする請求項7記載のインクカートリッジ。

【請求項10】 前記インク溜めに設けられ、前記空気導入孔に挿入可能な突起部材とを有するインク供給装置に着脱可能なインクカートリッジであって、前記空気導入孔内に移動可能に配置され、その移動により空気導入孔の開口を開閉する開閉部材と、前記開閉部材を前記空気導入孔の前記開口側に付勢し、開口を閉じる弾性部材とを備え、前記インクカートリッジが装着された状態では、前記突起部材が前記空気導入孔に挿入され、前記弾性部材に抗して前記部材が移動され、インクカートリッジ内と大気とが連通することを特徴とする請求項7記載のインクカートリッジ。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、インクジェットプリンタにおけるインク供給装置及びインクカートリッジに関するものである。

【0002】

【従来の技術】従来、装置の小型化および印字速度の高速化の要求から、特公昭61-60773号公報に記載されたインクカートリッジが提案されている。以下、その概要を説明する。

【0003】図3に示すように、圧電素子70、ノズル部72等から構成されるインクジェットヘッド74はキャリッジ本体76に固着される。キャリッジ78はシャフト80に摺動自在に取り付けられる。そのキャリッジ78が印字用紙の幅方向に沿って移動しながらインクジェットヘッド74が作動して印字を行っていく。インクジェットヘッド74に一端が接続された供給管82は、キャリッジ本体76上部から、キャリッジ本体76の印字紙とは反対側の背面に沿って下方に導かれる。インクジェットヘッド74および供給管82は、キャリッジ外壁84とキャリッジ本体76との間に形成された階段状室に収容され、この階段状室は、キャリッジ本体76底面近傍の背面に突出して設けたインク溜め86に接続される。

【0004】インク溜め86の上壁の一端（図3では右端）にはインク溜め86内を大気圧に保持するための通気孔88が設けられ、その上部には通気フィルタ90が装着されている。また供給管82をインク溜め86の底面近傍まで挿入しておく。更に、インク溜め86の上壁には、インク導出管92及び大気連通管94を貫通させて装着する。

【0005】ここで、インク導出管92及び大気連通管94の図3中上端はくさび状に形成される。そして、インク導出管92は大気連通管94より短くし、インク導出管92の下端はインク溜め86の底面近傍に配置し、上端はインク溜め86の上壁から突出させる。大気連通管94の下端はインク溜め86の上壁の内側よりやや下方に配置し、上端はインク導出管92の上端より上方に配置する。インクカートリッジ96は弾性材料で構成され、内部にインク98が充填される。

【0006】ここで、インクカートリッジ96をキャリッジ78の上方からインク導出管92、大気連通管94に差し込むようにしてインク溜め86の上面に装着すると、インクカートリッジ96内のインク98がインク導出管92を介してインク溜め86内に流入する。インク溜め86内のインク液面が図3に示すように大気連通管94の下端に達するとインクカートリッジ96が大気と遮断されるためインク溜め86へのインク98の流出は止まり、インク98がインク溜め86から溢れることはない。

【0007】

【発明が解決しようとする課題】しかしながら、以上説明したように、インクカートリッジ96とインク溜め86とを連通させるためのくさび状開口部を有するインク導出管92及び大気連通管94がキャリッジ本体に設けられているので、インクカートリッジ96を着脱する際

に作業者の手、指等を損傷してしまう危険性があった。特に、インクカートリッジ96を搭載せずにキャリッジ78が移動した場合、キャリッジ78に固定された前記くさび状開口部が高速で移動することになるので、非常に危険である。

【0008】また、インクカートリッジ96とインク溜め86との連通を確実にするために、インク導出管92及び大気連通管94のくさび状開口部をある程度インクカートリッジ96内に突き抜ける必要がある。そのため、インクカートリッジ96内に突き出たインク導出管92の開口部より下方にあるインクを使いきることができない。更に、インクカートリッジ96をキャリッジ78から離脱したとき、インク導出管92の開口部より下方の残ったインクが、インク導出管92及び大気連通管94がインクカートリッジ96を貫通した部分から漏れて、装置が汚れてしまう。

【0009】本発明は、上述した問題点を解決するためになされたものであり、インクカートリッジの着脱を安全に行え、且つインクカートリッジ内のインクを使いきることができるインク供給装置及びインクカートリッジを提供することが目的である。

【0010】

【課題を解決するための手段】この目的を達成するために本発明の請求項1では、インクが貯蔵され、インクジェット装置に着脱可能なインクカートリッジと、前記インクカートリッジから導入されるインクをインクジェットヘッドに供給するインク溜めとを有するインク供給装置において、前記インクカートリッジに設けられ、インクカートリッジ内部の最下部に接し、そのインクカートリッジ内のインクを流出するインク排出孔と、前記インクカートリッジに設けられ、そのインクカートリッジ内部と大気とを連通する空気導入孔とを備え、前記インクカートリッジが装着された状態では、前記インク排出孔の開口端及び前記空気導入孔の開口端が前記インク溜め内に配置され、且つ前記空気導入孔の前記開口端が前記インク排出孔の開口端より上方に配置されている。

【0011】また、請求項5では、インクが貯蔵され、インクジェット装置に着脱可能なインクカートリッジと、前記インクカートリッジから導入されるインクをインクジェットヘッドに供給するインク溜めとを有するインク供給装置において、前記インクカートリッジに設けられ、インクカートリッジ内部の最下部に接し、そのインクカートリッジ内のインクを流出するインク排出孔と、前記インクカートリッジに設けられ、そのインクカートリッジ内部と大気とを連通する空気導入孔と、前記インク溜めと前記空気導入孔とを連通する連通孔とを備え、前記インクカートリッジが装着された状態では、前記インク排出孔の開口端及び前記連通孔の開口端とが前記インク溜め内に配置され、且つ連通孔の前記開口端がインク排出孔の前記開口端より上方に配置されている。

【0012】更に、請求項7では、インクが貯蔵され、インクジェットヘッドに供給するインク溜めを有するインク供給装置に着脱可能なインクカートリッジにおいて、前記インクカートリッジ内部の最下部に接し、そのインクカートリッジ内のインクを流出するインク排出孔と、前記インクカートリッジ内部と大気とを連通する空気導入孔とを備え、前記インクカートリッジが装着された状態では、前記インク排出孔の開口端及び前記空気導入孔の開口端が前記インク溜め内に配置され、且つ前記空気導入孔の前記開口端が前記インク排出孔の開口端より上方に配置されている。

【0013】

【作用】上記の構成を有する本発明では、インクが貯蔵されたインクカートリッジの装着状態では、前記空気導入孔から空気が導入され、インクカートリッジ内のインクがインク排出孔よりインク溜めへと流出する。それに伴って、インク溜め内のインク圧、もしくはインク液量が所定量に達すると流出が止まる。その後、インクジェットヘッドからインクが噴射され、インク溜め内のインクが消費されると、その分だけインクカートリッジよりインクが流出し、インクカートリッジ内のインクを使いきるまで、同様な動作が繰り返される。

【0014】

【実施例】以下、本発明を具体化した一実施例を図面を参照して説明する。

【0015】図1に示すように、キャリッジ12は、シャフト14に摺動自在に取付けられ、図示しない記録用紙の幅方向に沿って往復移動しながら、インクジェットヘッド16によりインクを噴出させ、記録を行う。そのインクジェットヘッド16は、ノズル部材2、圧電素子4、コネクタ6等から構成されており、圧電素子4とコネクタ6とは図示しない信号線により結ばれている。そして、コネクタ6には、外部から記録する画像情報に応じた電気信号が供給される。すると、圧電素子4が駆動されてインクが噴出される。

【0016】キャリッジ12には、インクジェットヘッド16がインクを噴出する方向を記録用紙に向けて固定されており、インクジェットヘッド16にはステンレスメッシュ等のフィルタ18を介して、インクジェットヘッド16にインクを供給する供給管20が接続されている。その供給管20はインクジェットヘッド16より下方に導かれ、キャリッジ12の底部にて図1中右側にL字形に曲げられ、液室22に接続される。そして、液室22はその上方に位置するインク溜め24に、フィルタ26を介して連通されている。そのインク溜め24の図1中右上の上壁には、インク溜め24内を大気圧に保持するための通気孔26が設けられ、その上部には通気フィルタ28が装着されている。

【0017】インク溜め24の上方に装填されるインクカートリッジ30の底面には、第一突出部34と第二突

出部38とが形成されており、その第一突出部34の長さは第二突出部38の長さより長く形成されている。第一突出部34にはインクカートリッジ30内のインクをインク溜め24に導出するインク排出孔32が形成され、第二突出部にはインクカートリッジ30内に空気を導入する空気導入孔36が形成されている。そして、インク排出孔32の内径は、インクカートリッジ30に充填されるインクの表面張力、粘性及びインクの水頭圧を考慮して、キャリッジ本体12に装填されていない時にいたずらに漏れ出さない様、適正に設計される。また、空気導入孔36の内径も空気が適正に流入される様に設計される。

【0018】そして、空気導入孔36内には、移動可能に球44が設けられ、且つその球44を空気導入孔36の大気側の開口に付勢するバネ42が設けられている。また、球44の下部にはOリング48が配置されている。このため、インクカートリッジ30が装着されていない状態では、バネ42の付勢によって球44がOリング48に押圧されて空気導入孔36の大気側の開口が閉じられている。

【0019】ところで、インクカートリッジ30の第二突出部38内の空気導入孔36に於て、インク66と大気との臨界面が形成される内径が、第一突出部34のインク排出孔32の内径よりも小さく設計すると、その臨界面の表面張力により、インクが空気導入孔36へと流出することが容易に防止することが出来る。このため、Oリング48等がインク66によって劣化することが無い。

【0020】そして、インク溜め24の上壁には、インクカートリッジ30が装填されると同時に第一突出部34と第二突出部38とが挿入される穴がそれぞれ設けられている。また、インク溜め24には多孔性部材であるフォーム40がフィルタ22に適度に圧接した状態で收容されている。そのフォーム40には切り欠き部50が形成されており、その切り欠き部50は第二突出部38が挿入され位置に配置されている。このフォーム40により、キャリッジ12が高速で往復移動した際のインク溜め24内のインクの飛散の防止および急激な圧力変動の緩和が行なわれる。

【0021】また、インク溜め24の下壁には、インクカートリッジ30がキャリッジ12に装填された際に、空気導入孔36に挿入され、球44をバネ42に抗して押圧する突起部材46が設置されている。その突起部材46の端部はインク溜め24内に配置されている。

【0022】ここで、インク66を充填されたインクカートリッジ30がキャリッジ12の上方から第一突出部34と第二突出部38がインク溜め24の上壁の前記穴に挿入されるようにしてインク溜め24の上面に装着されると、突起部材46が球44をバネ42に抗して上方に移動させ、空気導入孔36の大気側の開口が開放さ

れ、インクカートリッジ30内に空気が導入される。すると、インクカートリッジ30内のインク66が、インク排出孔32からインク溜め24内に流入する。このインクカートリッジ30が装着された状態では、インク排出孔32の大気側の開口端及び空気導入孔36の大気側の開口端がインク溜め24内に配置されると共に、空気導入孔36の大気側の開口端がインク排出孔32の大気側の開口端より上方に配置されている。

【0023】インク溜め24に流入したインクはフォーム40全体に浸透した後、切り欠き部50の周面であるフォーム40の目の粗さとインクの表面張力に左右される臨界面保持力がインクカートリッジ30内のインク66の水頭圧より大きい場合は、切り欠き部50にしみ出して切り欠き部50内のインク液面が上昇する。そして、切り欠き部50内のインク液面が空気導入孔36に達するとインクカートリッジ30内は大気から遮断され、インク溜め24内へのインク66の流出が止まる。

【0024】また、切り欠き部50の周面であるフォーム40の目の粗さとインクの表面張力に左右される界面保持力がインクカートリッジ30内のインク66の水頭圧より小さい場合は、切り欠き部50のインク臨界面における表面張力により、切り欠き部50よりインクがしみ出ることなく、インクがフォーム40に充填されフォーム40内のインク圧が、外部よりフォーム40に働くインク圧と釣り合うまで、インク66がインク排出孔より排出される。

【0025】ここで、フォーム40は、前述したインクの水頭圧や臨界面保持力の他に、キャリッジ12の移動で発生する圧力変動の緩和力、インクジェットヘッド16へインクを供給時における粘性抵抗、インクジェットヘッド16にかかる静的なインク圧力等を考慮して、適正に選定される。尚、本実施例においてインクジェットヘッド16はインクカートリッジ30より上部に配置されているが、ノズル部材2の径が数十ミクロンと十分に小さいため、その毛細管応力が、インクジェットヘッド16からフォーム40までの水頭差と釣り合いを保っている。

【0026】そして、インクジェットヘッド16からインクが噴出されると、ノズル部材2の毛細管応力によりインクを吸引し、フォーム40内のインクを消費する。フォーム40内のインクが消費されると、フォーム40内のインク圧が下がるか、もしくは切り欠き部50のインク液面が減少し、インクカートリッジ30より、インクが消費される前の状態までフォーム40にインクが充填される。インク溜め24内の空気がインクカートリッジ30内に導入されると共に、外部の空気が通気フィルタ28、通気孔26を経由してインク溜め24に補充されて、インク溜め24内が大気圧に保たれる。上述したインク補給の動作を繰り返すことにより、インクカートリッジ30内のインク66がなくなるまでインクジェッ

トヘッド16に一定の圧力のインクを供給することができる。

【0027】尚、インクジェットヘッド16からフィルタ26に至るインク通路に予めインクが充填されていない場合には、ノズル部材16のインクが噴出される側より、図示しない吸引手段を装着し、インク溜め24からインクを吸引して、前記インク通路にインクを充填する。

【0028】上述したように、インクカートリッジ30の底面にインク排出孔32が形成されているので、インクカートリッジ内のインク66をすべて使いきることができる。また、インクカートリッジ30をキャリッジ12に装着した状態では、空気導入孔36の大気側の開口端がインク排出孔32の大気側の開口端より上方に配置されているので、インク排出孔32の径をある程度大きくすることができる。このため、インクカートリッジ30内のインク66が少なくなると、インク66の水頭圧が低くなっても、インク66がインク排出孔32からインク溜め24に導出され、インク66をすべて使いきることができる。このようにインクカートリッジ30内のインク66をすべて使いきることができるので、インクカートリッジ30の交換時に、インクカートリッジ30内に残ったインク66によって、装置及び作業者の手などが汚れることがない。

【0029】更に、キャリッジ12の外部には、突出した部材が配置されていないので、インクカートリッジ30の着脱が安全に行うことができる。

【0030】また、インクカートリッジ30がキャリッジ12に装着されていない状態では、球44、バネ42及びリング48によって、空気導入孔36が閉じられているので、インクカートリッジ30がキャリッジ12に装着されるまでインク66が排出されることがない。このため、インクカートリッジ30の着脱において手などが汚れることがない。

【0031】次に、本発明の他の実施例を図2を参照して説明する。以下図1の実施例と同一の部材には同一の付号を付し、その説明を省略する。

【0032】インク溜め24aの上方に装填されるインクカートリッジ30aの底面にはインク排出孔32を有する第一突出部34が形成され、図2中右側には空気導入孔36aを有する第二突出部38aが形成されている。第二突出部38aの内部には、球44aがバネ42aによって下向きに付勢されている。そして、インクカートリッジ30aがキャリッジ12aに装填されていない時には、空気導入孔36a下部に設けられたリング48aを球44aが押圧して空気導入孔36aをシールドしている。

【0033】インク溜め24aの図2中右上の上壁には、空気導入路64が形成されている。その空気導入路64の上部には、リング62及び突起部材46aが設

けられている。また、空気導入路64の下端の開口はインク溜め24a内に配置されている。そして、インクカートリッジ30aが装填されると、空気導入孔36aの大気側の開口端がＯリング62と当接すると共に、突起部材46aがバネ42aに抗して球44aを上方に移動させる。すると、インクカートリッジ30a内は空気導入孔36a及び空気導入路64を介してインク溜め24と連通される。このとき、空気導入路64の下端はインク排出孔32の大気側の開口端より上方に配置されている。

【0034】そして、インクカートリッジ30a内部にインク溜め24aより空気導入路64及び空気導入孔36aを経て大気が導入され、インクカートリッジ30a内部のインク66がインク排出孔32よりインク溜め24aに排出される。インクの噴射に伴うインク溜め24aへの補給は図1の実施例と同様に行われる。

【0035】このように構成しても図1の実施例と同様の効果が得られる。

【0036】

【発明の効果】以上説明したことから明かなように、本発明によれば、インクカートリッジの最下部にインク排出孔が設けられているので、インクカートリッジ内のインクをすべて使いきることができる。また、インクカートリッジ内に空気が導入される孔の下端がインク排出孔の開口端より上方に配置されているので、インク排出孔

の径をある程度大きく形成することができる。このため、インクカートリッジ内のインクが少なくなっても、インクの水圧が低くなくても、インクがインク排出孔から導出され、インクをすべて使いきることができる。このようにインクカートリッジ内のインクをすべて使いきることができるので、インクカートリッジの交換時に、インクカートリッジ内に残ったインクによって、装置及び作業者の手などが汚れることがない。更に、インクカートリッジを装着する部分の周辺に突出した部材が設けられていないので、安全にインクカートリッジの着脱を行うことができる。

【図面の簡単な説明】

【図1】本発明の一実施例のインク供給装置及びインクカートリッジを示す構成図である。

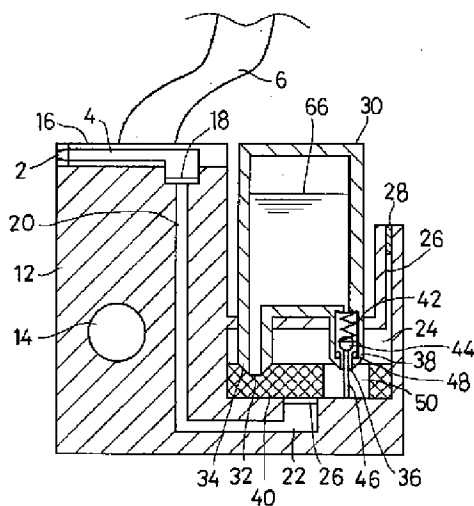
【図2】本発明の他の実施例のインク供給装置及びインクカートリッジを示す構成図である。

【図3】従来技術の実施例のインク供給装置及びインクカートリッジを示す構成図である。

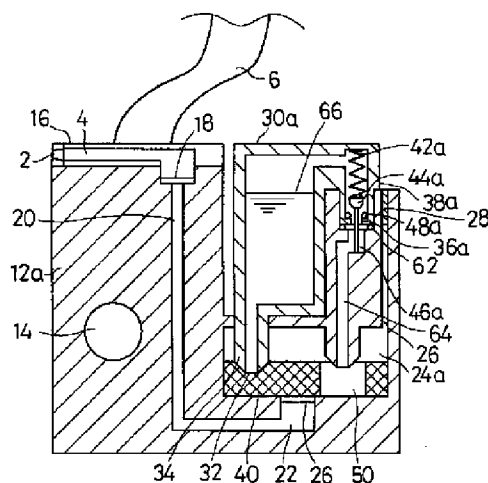
【符号の説明】

- 16 インクジェットヘッド
- 24 インク溜め
- 30 インクカートリッジ
- 32 インク排出孔
- 36 空気導入孔
- 66 インク

【図1】



【図2】



【図3】

